



Nakamichi T-100

Audio Analyzer Owner's Manual



CAUTION

TO REDUCE THE RISK OF
ELECTRIC SHOCK, DO NOT
REMOVE COVER (OR BACK). NO
USER-SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED
SERVICE PERSONNEL.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure; that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions, in the literature accompanying the appliance.

WARNING

TO PREVENT FIRE OR SHOCK
HAZARD, DO NOT EXPOSE THIS
APPLIANCE TO RAIN OR MOISTURE.

Please record the Model Number and Serial
Number in the space provided below and
retain these numbers.

Model Number and Serial Number are
located on the rear panel of the unit.

Model Number: Nakamichi T-100

Serial Number : _____

The Nakamichi T-100 Audio Analyzer is a powerful diagnostic instrument which enables you to get the optimum performance from your audio system. Originally conceived as a tool for the serious recordist, the Analyzer also provides valuable information about preamplifiers, amplifiers, turntables, phonograph cartridges, loudspeakers, and microphones.

The T-100 incorporates the functions of an oscillator, a vacuum tube volt meter (VTVM), a distortion meter, and a wow & flutter meter in a compact, portable form. The oscillator provides 21 different frequencies and pink noise for accurate frequency measurements from 20 Hz to 20 kHz. The pink noise generator is particularly useful for subjective testing of tape decks, loudspeakers, and microphones. The 400 Hz oscillator can be used with the built-in distortion analyzer to measure the harmonic distortion of tape decks and amplifiers. The 3 kHz oscillator allows you to test a tape deck's record/play wow & flutter. (You have a choice of weighted or unweighted readings.) With a 3 kHz test tape, you can measure playback-only tape speed deviation and wow & flutter. With a 3 kHz test record, you can measure turntable wow & flutter. The T-100 also provides A-Weighted noise readings of inputs down to 10 μ V. Finally, the Analyzer provides extremely accurate peak or average level indication. You can use the Analyzer to supplement the VU meters of your tape deck and avoid tape saturation when you record. By connecting the Analyzer in parallel with your speakers, you can avoid amplifier/speaker overload when you play back.

The controls and features of the T-100 may, at first, be unfamiliar. But despite its sophisticated functions, the T-100 Audio Analyzer is relatively simple to connect and use. The procedures and charts in this manual have been designed to help you make the fullest use of the T-100 in the shortest possible time.

Nakamichi Corporation

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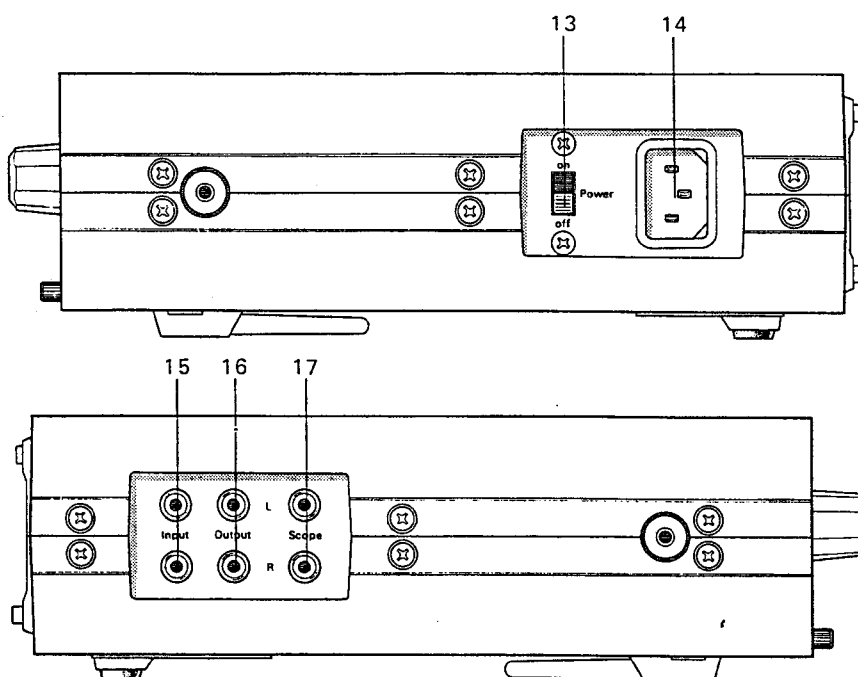
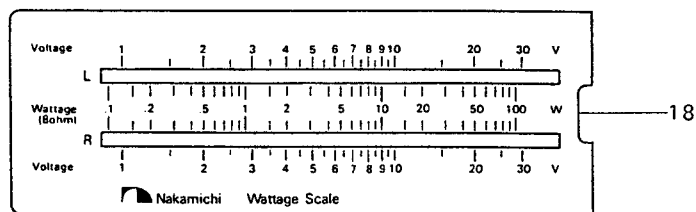
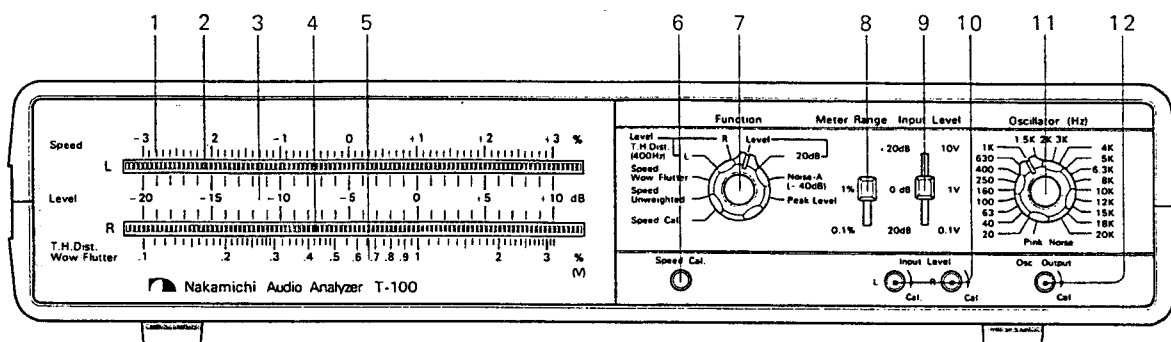
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Functions and Features



1. Speed Deviation Scale

Calibrated from -3% to +3%.

2. Top Indicator

Gas discharge display.

3. Level Scale

Calibrated from -20 to +10 dB.

4. Bottom Indicator

Gas discharge display

5. Total Harmonic Distortion/Wow & Flutter Scale

With the Meter Range switch in the "1%" position, the scale reads from 0.1% to 3%. With the meter range switch in the "0.1%" position, the scale reads from 0.01% to 0.3%. This scale also provides voltage readings in certain modes.

6. Speed Calibration Control

When the Function control is set to "Speed Cal" this control calibrates the top indicator to zero speed deviation.

7 Function Control

Speed Cal: calibrates top indicator for zero speed deviation.

Speed Unweighted: selects speed deviation in the top indicator and unweighted wow & flutter peak on the bottom indicator.

Speed Wow/Flutter: selects speed deviation on the top indicator and weighted wow & flutter peak on the bottom indicator.

Level T.H. Dist L: selects left channel level on the top indicator and left channel total harmonic distortion on the bottom indicator.

Level T.H. Dist. R: selects right channel level on the top indicator and right channel total harmonic distortion on the bottom indicator.

Level: selects left channel level on the top indicator, right channel level on the bottom indicator.

Level -20dB: decreases oscillator output by 20dB while simultaneously making the indicators 20dB more sensitive. Selects left channel level on the top indicator, right channel level on the bottom indicator.

Noise -40dB: displays left channel A-weighted noise on the top indicator, right channel A-weighted noise on the bottom indicator. Makes the display 40dB more sensitive.

Peak: selects peak-reading ballistics for the level display. Selects left channel level on the top indicator, right channel level on the bottom indicator. When the left and right input level controls are turned to maximum, the sensitivity of the display is the same as when the function control is set to "Level." However, by turning the input level controls counterclockwise, you can reduce the sensitivity to any intermediate value.

8 Meter Range Switch

Selects the meter range for the bottom indicator when the function control is set to "Speed Unweighted," "Speed Wow/Flutter," "Level T.H. Dist. L," and "Level T.H. Dist. R." With the Meter Range switch in the "1%" position, the scale reads from 0.1% to 3%. With the switch in the "0.1%" position, the scale reads from 0.01% to 0.3%. With the function control set to "Level," "Level -20dB," "Noise -40dB," or "Peak," the Meter Range switch changes the sensitivity for both indicators by 20dB.

9 Input Level Switch

Controls the sensitivity of the top indicator when the Function control is set to "Level T.H. Dist. L," and "Level T.H. Dist. R." Controls the sensitivity both indicators when the Function control is set to "Level," "Level -20dB," "Noise -40dB," or "Peak."

10 Input Level Controls

Adjust the sensitivity of the indicators when the Function control is set to "Peak." With these controls turned fully clockwise, the sensitivity will be the same as when the Function control is set to "Level." Turning these controls counterclockwise will lower the sensitivity to any intermediate value.

11 Oscillator Control

Selects one of 21 oscillator frequencies or pink noise. When the Function control is set to "Level T.H. Dist. L" or "Level T.H. Dist. R." the oscillator will produce a 400 Hz tone regardless of the position of the Oscillator control. Similarly, when the Function control is set to "Speed Cal," "Speed Unweighted," or "Speed Wow/Flutter," the oscillator will produce a 3 kHz tone regardless of the position of the Oscillator control. Setting the Oscillator control to the unmarked detent between "Pink Noise" and "20K" will turn off the oscillator.

12 Oscillator Output Control

13 Power Switch

14 AC Cord Connector

15 Input Jacks

16 Oscillator Output Jacks

17 Scope Jacks

These jacks allow you to connect the Analyzer output to an oscilloscope.

Warning: Do not under any circumstances connect the "Scope" output jacks (17) to any input of your preamplifier, amplifier or receiver. In certain situations the T-100 will produce a D.C. signal through the scope output which may cause serious damage to your loudspeakers and other components.

18 Wattage Scale

This scale, included as an accessory, fits over the display portion of the analyzer and provides direct wattage and voltage readings for power amplifier measurements.

CAUTION

Although the T-100 can be used from the moment it is turned on, it is recommended that you allow the Analyzer to "warm up" for at least ten minutes before performing any critical measurements where maximum accuracy is required.

Indicator Status Charts

Before you use the analyzer, take some time to familiarize yourself with the Indicator Status Chart. The Chart will help you understand the logic of the T-100's layout. It helps explain some of the apparent inconsistencies of the display (for example: although the top indicator usually displays the left channel level, when the function switch is set to "Level T.H. Dist. R," the indicator shows the right channel level). And it helps you to take advantage of the wide range of sensitivity. The following meter voltage chart can be used with the indicator status chart to calibrate inputs and outputs for a variety of applications.

CONTROL SETTING			INDICATOR STATUS	
FUNCTION SETTING	METER RANGE SWITCH	INPUT LEVEL SWITCH	TOP INDICATOR	BOTTOM INDICATOR
Speed Cal.	(any)	(any)	Speed Deviation -3 to +3%	(inactive)
Speed Unweighted	1% 0.1%	(any) (any)	Speed Deviation -3 to +3% -3 to +3%	Unweighted Wow/Flutter (peak) 0.1 to 3% 0.01 to 0.3%
Speed Wow/Flutter	1% 0.1%	(any) (any)	Speed Deviation -3 to +3% -3 to +3%	Weighted Wow/Flutter (peak) 0.1 to 3% 0.1 to 0.3%
Level, T.H. Dist.	1% 1% 1% 0.1% 0.1% 0.1%	10V 1V 0.1V 10V 1V 0.1V	L or R Total Input Level 0dB = 10V 0dB = 1V 0dB = 0.1V 0dB = 10V 0dB = 1V 0dB = 0.1V	L or R Total Harmonic Distortion 0.1 to 3% 0.1 to 3% 0.1 to 3% 0.01 to 0.3% 0.01 to 0.3% 0.01 to 0.3%
Level	1% 1% 1% 0.1% 0.1% 0.1%	10V 1V 0.1V 10V 1V 0.1V	Left Input Level 0dB = 10V 0dB = 1V 0dB = 0.1V 0dB = 10V 0dB = 1V 0dB = 10mV	Right Input Level 0dB = 10V 0dB = 1V 0dB = 0.1V 0dB = 1V 0dB = 0.1V 0dB = 10mV

CONTROL SETTING			INDICATOR STATUS	
FUNCTION SETTING	METER RANGE SWITCH	INPUT LEVEL SWITCH	TOP INDICATOR	BOTTOM INDICATOR
Level, -20 -20dB	1% 1% 1% 0.1% 0.1% 0.1%	10V 1V 0.1V 10V 1V 0.1V	Left Input Level 0dB = 1V 0dB = 0.1V 0dB = 10mV 0dB = 0.1V 0dB = 10mV 0dB = 1mV	Right Input Level 0dB = 1V 0dB = 0.1V 0dB = 10mV 0dB = 0.1V 0dB = 10mV 0dB = 1mV
Noise, -40dB	1% 1% 1% 0.1% 0.1%	10V 1V 0.1V 10V 1V	Left A-Weighted Noise 0dB = 0.1V 0dB = 10mV 0dB = 1mV 0dB = 10mV 0dB = 1mV	Right A-Weighted Noise 0dB = 0.1V 0dB = 10mV 0dB = 1mV 0dB = 10mV 0dB = 1mV
Peak*	1% 1% 1% 0.1% 0.1% 0.1%	10V 1V 0.1V 10V 1V 0.1V	Left Input Level 0dB = 10V 0dB = 1V 0dB = 0.1V 0dB = 1V 0dB = 0.1V 0dB = 10mV	Right Input Level 0dB = 10V 0dB = 1V 0dB = 0.1V 0dB = 1V 0dB = 0.1V 0dB = 10mV

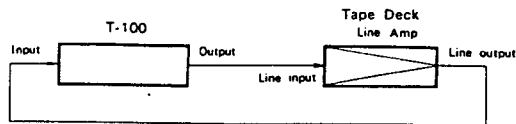
* With the Function control set to "Peak", the Input Level controls (10) can be used to adjust the sensitivity of the indicators to any intermediate value. Hence these 0 dB values only apply when the input level controls are turned fully clockwise.

Meter Reading	Voltage When 0dB = 10V	Voltage When 0dB = 1V	Voltage When 0dB = 0.1V	Voltage When 0dB = 10mV	Voltage When 0dB = 1mV	Voltage When 0dB = 0.1mV	Meter Reading
+10dB	31.62V	3.162V	0.3162V	31.62mV	3.162mV	0.3162mV	+10dB
+9dB	28.18V	2.818V	0.2818V	28.18mV	2.818mV	0.2818mV	+9dB
+8dB	25.12V	2.512V	0.2512V	25.12mV	2.512mV	0.2512mV	+8dB
+7dB	22.39V	2.239V	0.2239V	22.39mV	2.239mV	0.2239mV	+7dB
+6dB	19.95V	1.995V	0.1995V	19.95mV	1.995mV	0.1995mV	+6dB
+5dB	17.78V	1.778V	0.1778V	17.78mV	1.778mV	0.1778mV	+5dB
+4dB	15.85V	1.585V	0.1585V	15.85mV	1.585mV	0.1585mV	+4dB
+3dB	14.13V	1.413V	0.1413V	14.13mV	1.413mV	0.1413mV	+3dB
+2dB	12.59V	1.259V	0.1259V	12.59mV	1.259mV	0.1259mV	+2dB
+1dB	11.22V	1.122V	0.1122V	11.22mV	1.122mV	0.1122mV	+1dB
0dB	10.00V	1.000V	0.1000V	10.00mV	1.000mV	0.1000mV	0dB
-1dB	8.91V	0.891V	0.0891V	8.91mV	0.891mV	0.0891mV	-1dB
-2dB	7.94V	0.794V	0.0794V	7.94mV	0.794mV	0.0794mV	-2dB
-3dB	7.08V	0.708V	0.0708V	7.08mV	0.708mV	0.0708mV	-3dB
-4dB	6.31V	0.631V	0.0631V	6.31mV	0.631mV	0.0631mV	-4dB
-5dB	5.62V	0.562V	0.0562V	5.62mV	0.562mV	0.0562mV	-5dB
-6dB	5.01V	0.501V	0.0501V	5.01mV	0.501mV	0.0501mV	-6dB
-7dB	4.47V	0.447V	0.0447V	4.47mV	0.447mV	0.0447mV	-7dB
-8dB	3.98V	0.398V	0.0398V	3.98mV	0.398mV	0.0398mV	-8dB
-9dB	3.55V	0.355V	0.0355V	3.55mV	0.355mV	0.0355mV	-9dB
-10dB	3.16V	0.316V	0.0316V	3.16mV	0.316mV	0.0316mV	-10dB
-11dB	2.82V	0.282V	0.0282V	2.82mV	0.282mV	0.0282mV	-11dB
-12dB	2.51V	0.251V	0.0251V	2.51mV	0.251mV	0.0251mV	-12dB
-13dB	2.24V	0.224V	0.0224V	2.24mV	0.224mV	0.0224mV	-13dB
-14dB	2.00V	0.200V	0.0200V	2.00mV	0.200mV	0.0200mV	-14dB
-15dB	1.78V	0.178V	0.0178V	1.78mV	0.178mV	0.0178mV	-15dB
-16dB	1.58V	0.158V	0.0158V	1.58mV	0.158mV	0.0158mV	-16dB
-17dB	1.41V	0.141V	0.0141V	1.41mV	0.141mV	0.0141mV	-17dB
-18dB	1.26V	0.126V	0.0126V	1.26mV	0.126mV	0.0126mV	-18dB
-19dB	1.12V	0.112V	0.0112V	1.12mV	0.112mV	0.0112mV	-19dB
-20dB	1.00V	0.100V	0.0100V	1.00mV	0.100mV	0.0100mV	-20dB

1. Tape Decks

1.1 Frequency Response

Line Amplifier



1.11 Line Amplifier (of a three-head deck)

1.111 Connect the Output jacks (16) to the line input jacks of the tape deck. Connect the line output jacks of the tape deck to the Input jacks (15).

1.112 Set the Function control (7) to "Level."

1.113 Set the Oscillator control (11) to your reference frequency (usually 400 Hz or 1 kHz).

1.114 Set the tape deck's "monitor" switch to "source."

1.115 Adjust the tape deck's line input level controls so that the tape deck's meters indicate 0 dB (0 VU). If you find that you cannot get a 0 dB reading on the tape deck's meters even when the tape deck's line input controls are turned all the way up, turn the Oscillator Output control (12) clockwise until the tape deck meters read 0 dB.

1.116 Adjust the line output level of the tape deck so that the top (2) and bottom (4) indicators read 0 dB or any other convenient level you wish to use as a standard.

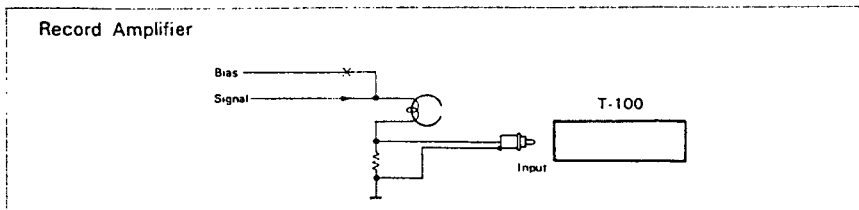
1.117 Set the Function control (7) to "Level -20dB." This will reduce the Oscillator Output by 20 dB while simultaneously increasing the sensitivity of the indicators by 20 dB, so that the indicator level remains unchanged. (You can verify the reduction in oscillator output by checking the tape deck's meters.)

1.118 Set the Oscillator control (11) to 20 Hz. Make a record of the top (2) and bottom (4) indicator readings. Repeat for each frequency up to 20 kHz. You can plot the output levels against frequency to make a curve representing the line amplifier frequency response.

1.12 Record Amplifier

If you are capable of locating circuit parts and making internal probes and disconnections in your tape deck, then you can measure the frequency response characteristics of the record amplifier. Note that many tape deck manufacturers' warranties are voided when the user modifies or abuses the deck. Consequently, any damage to the tape deck resulting from the improper execution of this procedure may void your tape deck warranty. Note that it is not sufficient to merely measure the voltage across the record head terminals. Since the record head impedance varies with frequency, this method will result in an inaccurate measurement of the record amplifier frequency response (generally, exaggerated lows and highs). In order to obtain accurate readings, you must disconnect the negative (return) lead from the record head and insert a 100 Ohm series resistor. You can then measure the voltage drop across the resistor (the difference in voltage between one side of the resistor and the other). Many tape decks provide a built-in series resistor with clearly marked test points precisely for this purpose. If you are unsure about your deck, consult the unit's service manual or check with its manufacturer before proceeding.

It will also be necessary to disconnect the bias oscillator from the record head in order to make an accurate measurement of the record amplifier. Again, many tape decks provide a simple means of disconnecting the bias oscillator, such as with a jumper cable, in order to facilitate this procedure.



Here, too, it is best to study the deck's service manual carefully.

Remember to re-connect the bias oscillator and restore the record head connections (if they were modified) when you have completed the measurements.

1.121 Connect the Output jacks (16) to the line input jacks of the tape recorder. Connect either end of the record head series resistor to the Input jacks (14).

1.122 Set the Function control (7) to "level."

1.123 Set the Oscillator control (11) to your reference frequency (usually 400 Hz or 1 kHz).

1.124 Set the tape deck in the record mode. (If you are measuring a cassette deck you will have to load a cassette.)

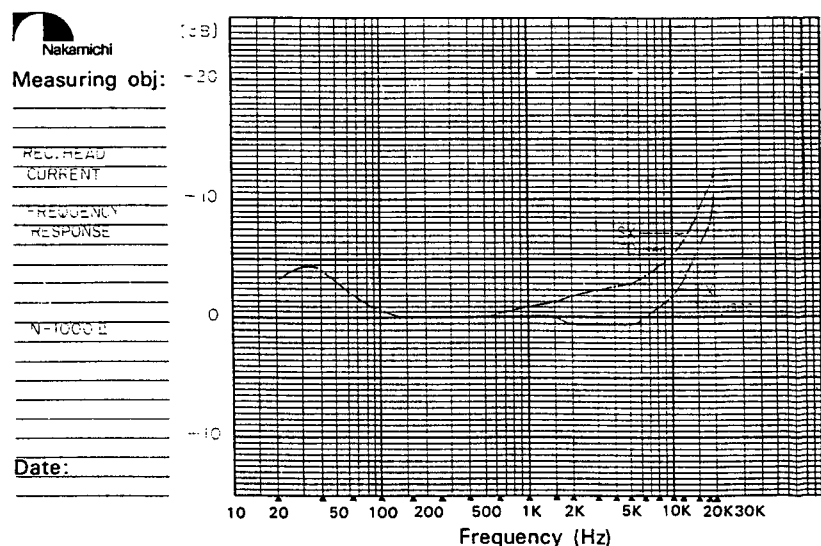
1.125 Adjust the line input level of the tape deck so that the tape deck meters read 0 dB (0 VU). If you find that you cannot get a 0 dB reading on the tape deck's meters even when the tape deck's line input controls are turned all the way up, turn the Oscillator Output control (12) clockwise until the tape deck meters read 0 dB.

1.126 Set the Meter Range (8) and Input Level (9) switches so that the top (2) and bottom (4) indicators read at a convenient standard level.

1.127 Set the Function control (7) to "Level -20dB." This will reduce the oscillator output by 20 dB while simultaneously increasing the sensitivity of the indicators by 20 dB, so that the indicator level remains unchanged. (You can verify the reduction in oscillator output by checking the tape deck's meters.)

1.128 Set the Oscillator control (11) to

20 Hz. Make a record of the top (2) and bottom (4) indicator readings. You may have to increase the indicator sensitivity by 20 dB in order to obtain a reading of the lowest frequencies. To increase sensitivity, move either the Meter Range (8) or the Input Level (9) switch down one step. You will then bring the indicator sensitivity down one 20 dB step for the middle frequencies. You may also need to bring the sensitivity down an additional step to measure the high frequencies. You can plot the output levels against frequency to make a curve of the record amplifier frequency response and equalization. But remember to add and subtract 20 dB where appropriate to compensate for the difference in indicator sensitivity ranges. If the tape deck offers switchable equalization, you can test the record amplifier at each setting.



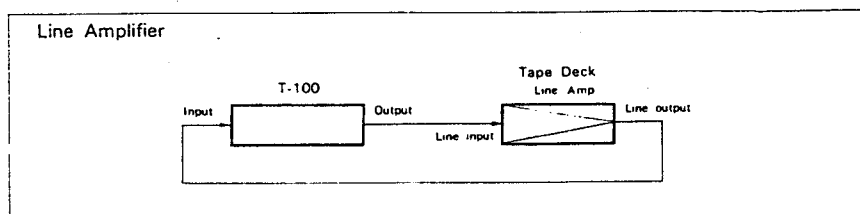
1.2 Total Harmonic Distortion

1.21 Line Amplifier (of a three-head tape deck)

1.21 Connect the Output jacks (16) to the line input jacks of the tape deck. Connect the line output jacks of the tape deck to the Input jacks (5).

1.212 Set the tape deck's "monitor" switch to "source."

1.213 Turn down the Oscillator Output control (12) to minimum. Turn up the tape deck's line input controls to maximum. Slowly advance the Oscillator Output control until the tape deck's meters read 0 dB (0 VU).



1.214 Set the Function control (7) to "Level T.H. Dist. R."

1.215 Set the tape deck's output control to maximum. Adjust the Input Level switch (9) so that the top indicator reads between -10 and +10 dB. Read the right channel distortion on the

bottom indicator. Remember that the distortion readings vary according to the position of the Meter Range switch (8).

1.216 Set the Function control (7) to "Level T.H. Dist. L" and read the distortion of the left channel on the bottom indicator.

1.22 Record/Playback

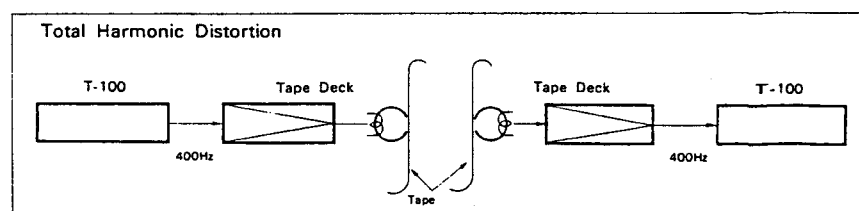
1.221 Connect the Output jacks (16) to the line input jacks of the tape deck. Connect the line output jacks of the tape deck to the Input jacks (15).

1.222 Load a tape into your tape deck and make the appropriate bias and equalization adjustments. Put the tape deck into the record/pause mode.

1.223 Set the Function control (7) to "Level T. H. Dist. R."

1.224 Turn down the Oscillator Output control (12) to minimum. Turn up the tape deck's line input controls to maximum. Slowly advance the Oscillator Output control until the tape deck's meters read 0 dB (0 VU).

1.225 Record about one minute of the 400 Hz oscillator tone.



1.226 Rewind the tape and play back the tone.

1.227 Set the tape deck's line output control to maximum. Adjust the Input Level switch (9) so that the top indicator reads between -10 and +10 dB. Read the right channel distortion on the bottom indicator. Remember that the distortion readings vary according to the position of the Meter Range switch (8).

1.228 Set the Function control (7) to "Level T.H. Dist. L" and read the distortion of the left channel on the bottom indicator. Note that with a three-head tape deck you can read the record/playback distortion as you record by switching the "monitor" switch to "tape" as you record.

1.23 Record/Playback Level Versus Distortion

1.231 Follow steps 1.221 through 1.228.

1.232 Connect the Output jacks (16) to the Input jacks (15).

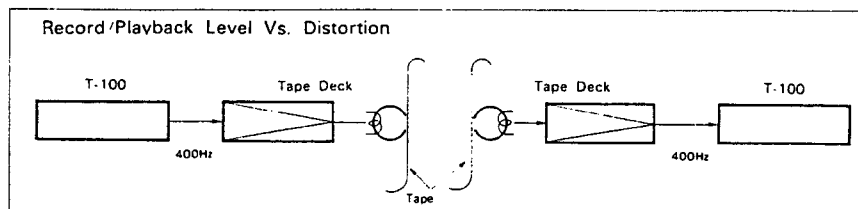
1.233 Set the Function control (7) to "Level."

1.234 Move the Meter Range switch (8) and the Input Level switch (9) until the oscillator output level is indicated on the top (2) and bottom (4) indicators.

1.235 Make a note of the position of the Meter Range and Input Level switches, and the dB reading of the oscillator output. Then use the Oscillator Output control (12) to decrease the reading by two dB.

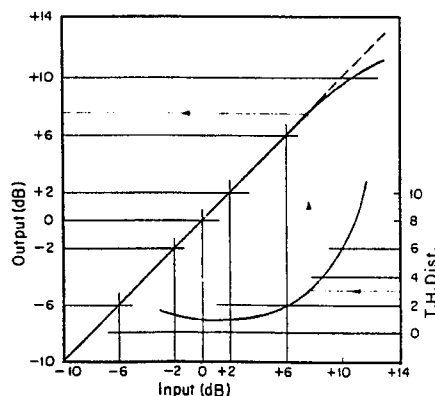
1.236 You are now ready to measure record/playback distortion at -2 dB (-2 VU). You have used the analyzer's own meters to calibrate the oscillator output rather than the tape deck's meters. To make the measurement, follow steps 1.221, 1.223, and 1.225 through 1.228.

1.237 In the same manner, recalibrate the Oscillator Output for -4 , -6 , -8 , -10 , $+2$, $+4$, $+6$, $+8$, and $+10$ dB and measure the distortion at these levels. Remember that to obtain an accurate distortion reading, you must adjust the Input Level switch (9) so that the level read between -10 and $+10$ dB. Remember that the distortion readings vary according to the position of the Meter Range switch (8).



1.238 You can plot the distortion readings against the tape deck input level. When the input level is low, the analyzer reads mostly noise components. As the input level increases, the distortion reading will tend to decrease. At very high input levels, tape saturation distortion sets in and the distortion readings will increase rapidly. You may notice a decrease in distortion if you make measurements using high-cut filters, noise reduction systems, etc. These will tend to reduce the noise components which reach the Analyzer.

Record/Playback Level vs. T.H.D.



1.44 Record/Playback

1.441 Connect the Output Jacks (16) to the line input jacks of the tape deck. Connect the line output jacks of the tape deck to the Input jacks (15).

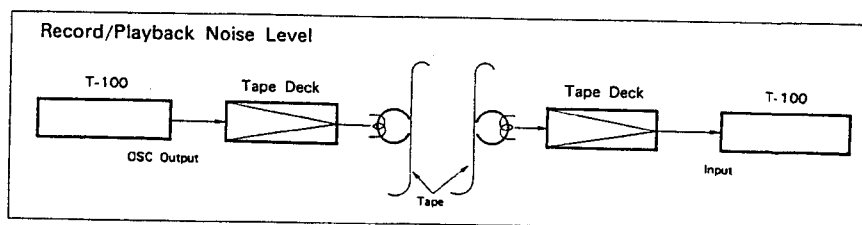
1.442 Set the Function control (7) to "Level". Set the Oscillator control (11) to 400 Hz.

1.443 Load a fresh tape into your tape deck and select the appropriate bias and equalization positions. Put the tape deck into the record/pause mode.

1.444 Adjust the tape deck's line input level controls so that the tape deck's meters indicate 0 dB (0 VU). If you find that you cannot get a 0 dB reading on the tape deck's meters even when the tape deck's line input controls are turned all the way up, turn the Oscillator Output control (12) clockwise until the tape deck meters read 0 dB.

1.445 Record about 30 seconds of the 400 Hz tone. Then, while the tape deck is recording, change the Function control (7) setting to "Noise-A (-40dB)". This will disconnect the oscillator and short the tape deck line inputs. Record for about 30 seconds to get a sample of tape noise.

1.446 Return the Function control (7) to "Level". Rewind the tape and play back. Adjust the line output levels of the tape deck so that the top (2) and bottom (4) indicators read 0 dB or any other convenient level you wish to use as a standard. Make a note of the indicator readings, and do



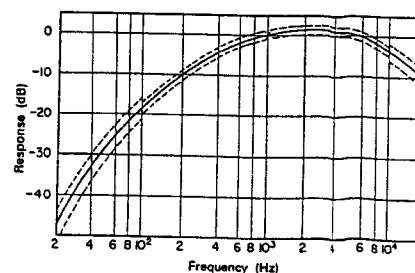
not alter the tape deck line output levels for the rest of this procedure.

1.447 When you have reached the end of the recorded 400 Hz tone, set the Function control (7) to "Noise-A (-40dB)". The IHF A-Weighted noise level should appear on the indicators. (If necessary, move the Meter Range (8) or Input Level (9) switch to get a reading.) The signal-to-noise ratio will be the difference in dB between the level of the 400 Hz tone and the noise level. Remember that setting the Function control to "Noise-A (-40dB)" automatically makes the display 40 dB more sensitive. For example, if the 400 Hz tone read at 0 dB and the noise level reads -18 dB, the signal-to-noise ratio is 58 dB. (Remember to account for each 20 dB change you make in either the Meter Range (8) or Input Level (9) switches. For example, if the 400 Hz tone read at 0 dB and if you have moved either switch down one step, and the noise level reads -2 dB, the signal-to-noise ratio is 62 dB.)

1.448 This signal-to-noise ratio is referenced to 0 dB (0 VU) and is IHF A-Weighted. Note that some tape deck manufacturers specify with different weighting curves, filters, with a 3% distortion level reference, or with the tape deck's noise reduct

reduction system switched on. The signal-to-noise ratio you measure may be different from, yet consistent with the manufacturer's specification. If your tape deck has a noise reduction system, you may wish to measure signal-to-noise with the system off and with it on. If you want to refer your measurement to the 3% distortion level, you can use procedure 1.23, Record/Playback Level Versus Distortion, to determine the difference between 0 dB (0 VU) and the 3% distortion level. For example, if you find that 3% distortion occurs at +3 dB, and the signal-to-noise ratio referenced to 0 dB was 58 dB, then the signal-to-noise referenced to 3% distortion will be 61 dB.

IHF A-Weighted Curve



1.5 Tape Speed, Wow & Flutter

There are two methods of measuring tape tape wow & flutter. One, playback-only, uses a 3 kHz test tape of presumed accuracy. The other, record/playback, uses the tape deck itself to make a

3 kHz tape and play the tape back. Obviously, the record/playback method results in higher figures. Record/playback readings are roughly 1.414 times playback-only readings. Inversely,

playback-only readings are roughly 0.707 times record/playback readings. Tape speed, it should be noted, can only be verified during playback using a standard pre-recorded 3 kHz test tape.

1.51 Test Tape Playback

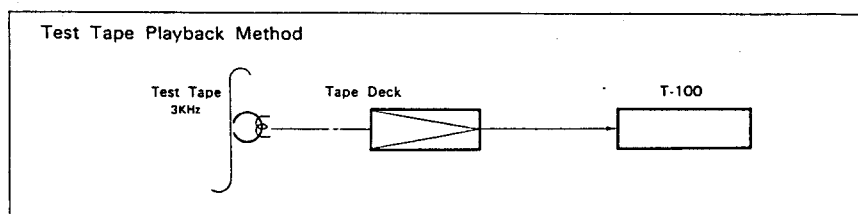
1.511 Set the Function control (7) to "Speed Cal."

1.512 Adjust the Speed Cal control (6) so that the top indicator (2) reads zero on the speed deviation scale (1).

1.513 Set the Function control (7) to "Speed Wow/Flutter".

1.514 Play back the 3 kHz test tape.

1.515 The top indicator (2) shows speed



deviation. The bottom indicator (4) shows weighted wow & flutter. Remember that the wow & flutter reading varies according to the position of the Meter Range switch (8). You can expect the wow & flutter reading

to fluctuate. Read the center value.

1.516 For unweighted wow & flutter readings, set the Function control (7) to "Speed Unweighted."

1.52 Record/Play

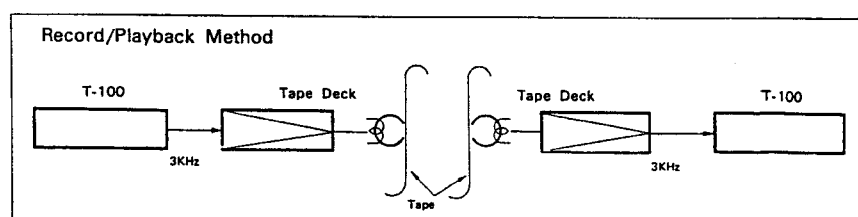
1.521 Connect the Output jacks (16) to the tape deck's line input jacks. Connect the tape deck's line output jacks to the Input jacks (15).

1.522 Set the Function control (7) to "Speed Cal." The oscillator output will be a 3 kHz tone regardless of the position of the Oscillator control (11).

1.523 Turn the Speed calibration control (6) so that the top indicator (2) reads zero on the speed deviation scale (1).

1.524 Set the Function control (7) to "Speed Wow/Flutter."

1.525 Set the tape deck's line input level controls and/or the oscillator output control so that the tape deck's meters read in the range



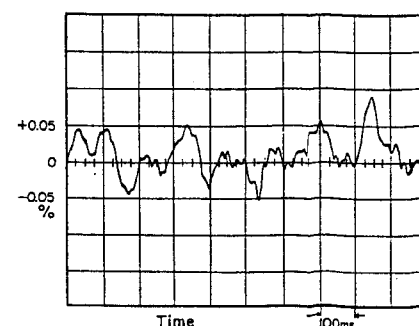
between -10 and 0 dB (VU).

1.526 Record the 3 kHz test tone.

1.527 Follow steps 1.514 through 1.516, but remember that you can measure only wow & flutter using this record/play method.

1.528 You can connect an oscilloscope to the right channel Scopé jack (17) to see the waveform of the demodulated signal.

Waveform of the Scope jack



1.6 Volume Indication

You can use the extreme accuracy and range of the T-100 indicators to supplement the meters of your tape deck as you record. Without manipulating the Meter Range (8) and Input Level (9) switches, you can read volume indication

from -20 to +10 dB. By changing the indicator sensitivity, you can extend the range even further. You can calibrate the peak indication so that 0 dB on the T-100 corresponds exactly to 0 dB (0 VU) on the tape deck's meters. This will enable

you to use the indicators on the T-100 exclusively, with the assurance that you are getting accurate input readings.

1.61 Peak Metering

1.611 Connect the line output jacks of the tape deck to the Input jacks (15). Connect the Output jacks (16) to the line input jacks of the tape deck.

1.612 Set the Oscillator control (11) to 400 Hz. Set the Function control (7) to "Peak."

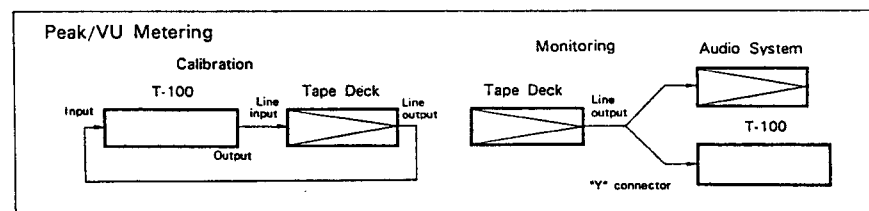
1.613 If the tape deck is a two-head machine, put the deck into record/pause mode. If the deck is a three-head machine, set the "monitor" switch to "source."

1.614 Adjust the tape deck line input level controls and/or the Oscillator Output control (12) so that the tape deck meters read 0 dB (0VU).

1.615 Set the tape deck line output level controls to a convenient point, i.e. where you normally set them for tape playback. As long as you will be using the T-100 for peak metering, do not alter the output level control settings.

1.616 Set the Meter Range (8) and Input Level (9) switches so that the indicators read slightly above 0 dB.

1.617 Turn the Input Level controls (10) counterclockwise until the indicators read 0 dB.



1.618 Disconnect the Outputs (16) from the tape deck line inputs. Connect the source to be recorded to the tape recorder. If you wish to monitor the tape recording through an audio system (as opposed to a pair of headphones) you will need "Y" connectors so that both the Analyzer and the audio system receive signal from the tape deck's line output jacks.

CAUTION

Under certain circumstances in the peak metering mode, it is possible to overload the input section circuitry of the T-100. Overload results in inaccurate readings and is indicated by arrested movement of the bar-graph display (the indicators will never "move" beyond a certain point). In such instances turning down the Input Level controls (10) will not help (electrically, they are positioned after the input circuitry). What does help is increasing the Input Level switch (9) setting (moving it up one step). A complementary decrease of the Meter Range switch (8) (moving it down, if it is not down already) will restore input sensitivity of the T-100 to the original level.

1.62 Average (VU) Metering

1.621 Set the Function control (7) to "Level."

1.622 Connect the line output jacks of the tape deck to the Input jacks (15). Connect the Output jacks (16) to the line input jacks of the tape deck.

1.623 Set the Oscillator control (11) to 400 Hz.

1.624 Follow steps 1.613 and 1.614.

1.625 Set the tape deck line output level controls so that the indicators read 0 dB. You may have to manipulate the Meter Range (8) and Input Level (9) switches to achieve this. Once the tape deck line output levels are set, do not change them as long as you will be using the T-100 for average metering.

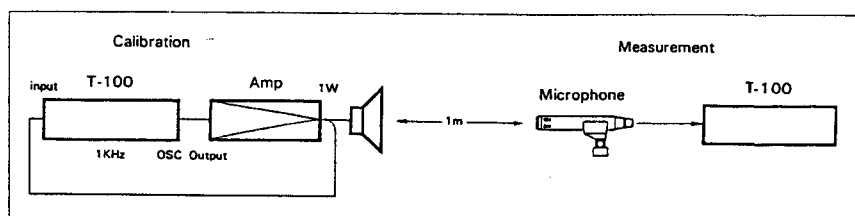
1.626 Follow step 1.618.

2.12 Microphone

Microphone output information is useful in judging the compatibility of a microphone with console and tape deck mic inputs. You may discover that the output is high enough to require attenuation, or low enough to require an outboard preamplifier and connection to a line-level input. In order to test a microphone, you need a "known" speaker. Specifically, you need to know the speaker sensitivity, usually measured in terms of sound pressure level (SPL) at one meter, on axis, with a 1-watt input. You must set out to reproduce these conditions. First you use the analyzer to calibrate a 1-watt input at 1 kHz. To do this, you must know the speaker impedance. Position the microphone one meter from the speaker, on axis. Then take measurements.

2.121 First calibrate a 1-watt input for the speakers. Connect the Output jacks (16) to the preamplifier "aux" input jacks. Connect the Input jacks (15) to the power amplifier speaker output terminals, in parallel with the speakers themselves.

2.122 Set the Function control (7) to "level -20dB." Set the Oscillator control (11) to "1K." Set the Meter Range switch (8) to "1%," and the input level switch to "10V." With these settings, zero dB equals 1 volt and maximum indication is 3.162 volts.

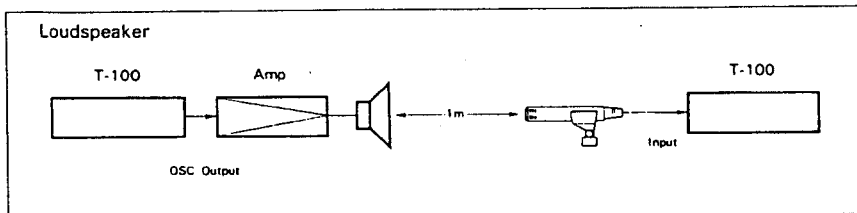


2.123 Set the preamplifier balance control so that only the speaker you will use to perform the test will play. Slowly advance the preamplifier volume control until the appropriate indicators read the proper voltage for 1 watt. This voltage is the square root of the speaker's impedance at 1 kHz. If your preamplifier volume control is a stepped attenuator, you will probably need some "fine turning" to get the proper output voltage reading. Use the Oscillator Output control (12) if necessary. Once the proper voltage is calibrated, do not touch the preamplifier volume control or the oscillator output control.

2.124 Turn off the power to the preamplifier and power amplifier. Disconnect the Inputs (15) from the amplifier's speaker output terminals. Position the microphone one meter from and directly in front of the loudspeaker.

2.125 Connect the microphone output to the left Input jack (15).

2.126 Turn on the system and play the calibrated 1 kHz test tone through the loudspeaker. Set the Meter Range switch (8) to "0.1%." Set the Input Level switch (9) to "0.1V." Zero dB will equal 1 millivolt. Read the microphone output voltage in dB from the top (2) indicator. You can also read millivolts directly by using the THD/Wow & Flutter scale (5). Remember that any change in the meter range (8) or input level (9) settings will result in a different 0 dB reference. Refer to the Indicator Status Charts on page 3, if there are any doubts as to scale reference. This is the output at the speaker's rated sound pressure level for these conditions. Microphone sensitivity is frequently expressed in millivolts per microbar (one microbar is approximately 74 dB SPL).



2.13 Loudspeaker

Speaker output level is useful in selecting a compatible amplifier for the room and desired sound pressure levels. In order to test a loudspeaker, you need a "known" microphone. Specifically, you need to know the microphone sensitivity, usually measured in terms of millivolts per microbar. You can also modify this procedure to measure sound pressure level of stereo pair at any listening position.

2.131 Calibrate a 1-watt input to the speakers by following steps 2.121, 2.122, and 2.123.

2.132 Connect the microphone according to steps 2.124 and 2.125.

2.133 Turn on the system and play the calibrated 1 kHz test tone through the loudspeaker. Set the Meter Range switch (8) to "0.1%." Set the Input Level switch (9) to "0.1V." Zero dB will equal 1 millivolt. Read the microphone output voltage in dB from the top (2) indicator. You can also read millivolts directly by using the THD/Wow & Flutter scale (5). Remember that any change in the meter range (8) or input level (9)

settings will result in a different 0-dB reference. Refer to the Indicator Status Charts on page 3, if there are any doubts as to scale reference.

Use the microphone sensitivity rating to calculate the speaker's sound pressure level. For example, if the microphone is rated at 0.5 millivolts per microbar, and the speaker causes the microphone to produce 2 millivolts, the speaker output is 86 dB SPL. (2 millivolts is 12 dB higher than 0.5 millivolts. 1 millibar is approximately 74 dB SPL. $74 + 12 = 86$).

2.2 Frequency Response

2.21 Cartridge

2.211 Connect the cartridge output cables to the Input jacks (15).

2.212 Set the Function control (7) to "Level -20dB," the Meter Range switch (8) to "0.1%," and the Input Level switch (9) to either "1V" or "0.1V" as appropriate.

2.213 Play the test record and record the cartridge output level in dB for each frequency. Remember that RIAA playback equalization boosts

RIAA Characteristics Chart

Frequency (Hz)	Recording (dB)	Playback (dB)	Frequency (Hz)	Recording (dB)	Playback (dB)	Frequency (Hz)	Recording (dB)	Playback (dB)
20	-19.27	+19.27	630	-1.64	+1.64	6.3k	+9.98	-9.98
40	-17.79	+17.79	1k	0.00	0.00	8k	+11.89	-11.89
63	-15.85	+15.85	1.5k	+1.40	-1.40	10k	+13.73	-13.73
100	-13.09	+14.09	2k	+2.59	-2.59	12k	+15.26	-15.26
160	-9.81	+9.81	3k	+4.74	-4.74	15k	+17.16	-17.16
250	-6.68	+6.68	4k	+6.61	-6.61	18k	+18.72	-18.72
400	-3.78	+3.78	5k	+8.21	-8.21	20k	+19.62	-19.62

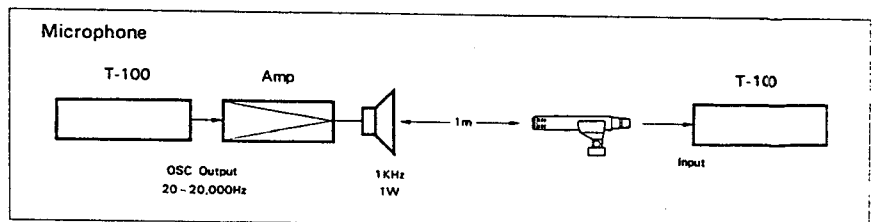
the bass and cuts the treble of the cartridge output. The unequalized cartridge output will have a rising frequency response characteristic, where the phono preamplifier output will have a flat characteristic.

NOTE: Although this chart provides values over an extended range of 20Hz to 20,000Hz, the official RIAA equalization is defined only from 30Hz to 15,000Hz.

2.22 Microphone

2.221 Follow steps 2.121 through 2.125.

2.222 Set the Oscillator control (11) to 20 Hz. Turn on the system and play the tone. Record the microphone output level in dB, as read from the top indicator (2). Repeat the procedure for each frequency up to 20 kHz. You can use the data to plot a curve of output levels against



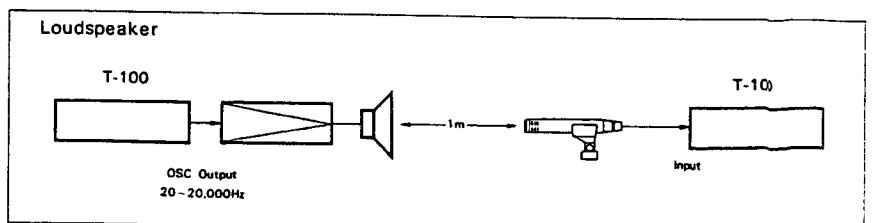
frequency. Remember that this is not an absolute measurement — re-read the introductory paragraphs for this

section (2. Transducers) if you have any questions regarding this procedure.

2.23 Loudspeaker

2.231 Follow steps 2.121 through 2.125.

2.232 Set the Oscillator control (11) to 20 Hz. Turn on the system and play the tone. Record the microphone output level in dB, as read from the top indicator (2). Repeat the procedure for each frequency up to 20 kHz. You can use the data to plot a curve of output levels against frequency. You can also measure the



response of a stereo pair at any listening position. You can measure the affects of manipulating the speaker's crossover controls. You can

determine the advantages of different speaker positions and orientations, not to mention of different speakers.

3. Amplifiers

3.1 Frequency Response

3.11 Tone Controls

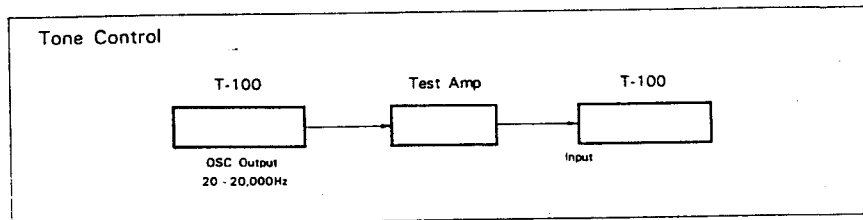
You can plot the frequency response of tone controls using the T-100. In most cases, you need only graph the effect of the tone control at its most extreme positions. It is usually safe to assume that intermediate settings will yield similarly-shaped curves of a milder degree. If you wish, you may test several intermediate positions so that you can calibrate the tone controls. After such calibration, you can set the tone controls for a precise boost or cut at a given frequency.

3.111 Connect the Output jacks (16) to the Input jacks (15). Set the Function control (7) to "Level." Set the Oscillator control (11) to 1 kHz. Set the Meter Range switch (8) to "1%," and the Input Level Switch (9) to "0.1V."

3.112 Turn the Oscillator Output control (12) so that the indicators read 0 dB. The oscillator output will be calibrated at 100 mV. This should be sufficient for most preamplifiers. If you have any doubt, check the preamplifier owner's manual.

3.113 If you are testing a separate preamplifier, disconnect the power amplifier to access the preamplifier output jacks. If you are testing an integrated amplifier or receiver, disconnect the "pre out/main in" plugs.

3.114 Connect the Output jacks (16) to the "aux" input jacks of your preamplifier. Connect the preamplifier output jacks to the Input jacks (15).



3.115 Set the preamplifier volume control to maximum. Set the preamplifier tone control(s) to the desired positions.

3.116 Set the Oscillator control (11) to 20 Hz. Make a record of the top (2) and bottom (4) indicator readings.

Repeat for each frequency up to 20 kHz. You can plot the output levels against frequency to make a curve of the tone control's frequency effects. By repeating the procedure at various settings, you can compile a family of related curves.

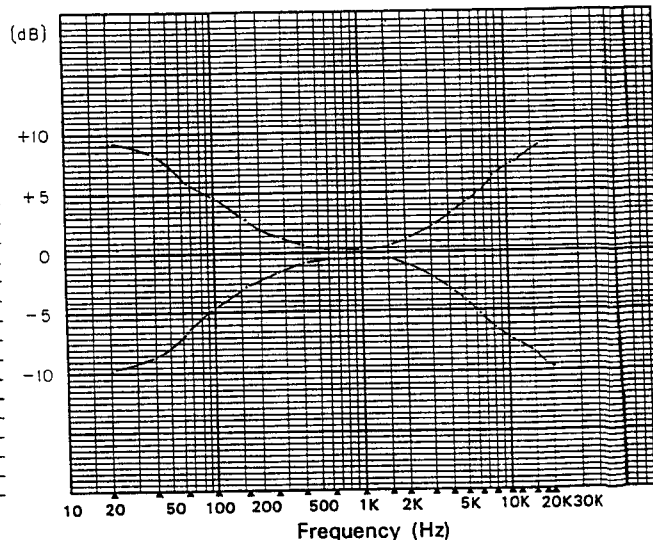


Measuring obj:

TONE CONTROL
RESPONSE

Nakamichi 410

Date:

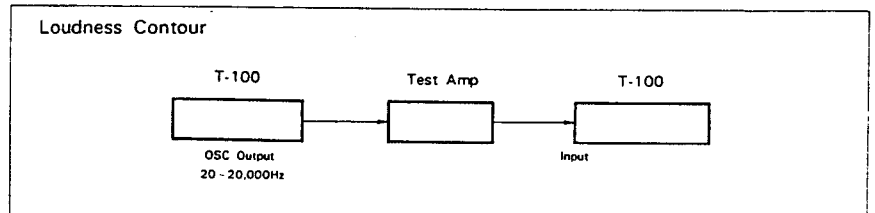


3.12 Loudness Contour Controls

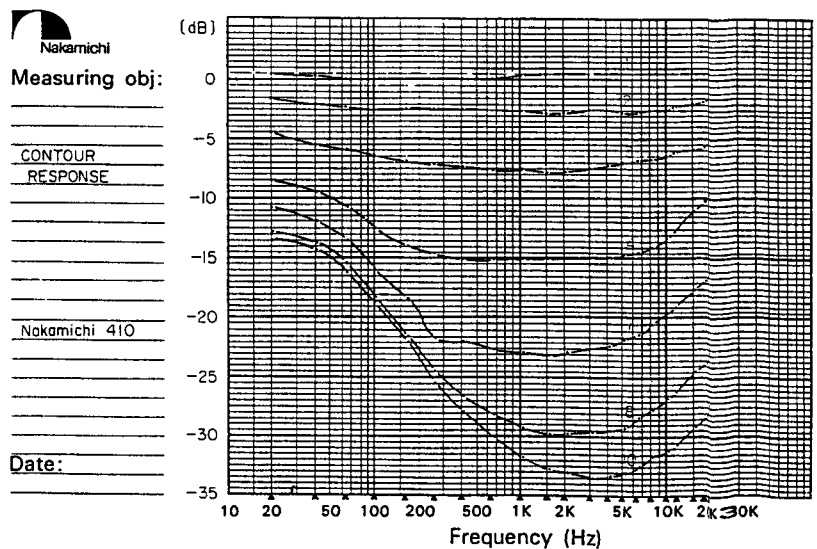
Loudness contour controls compensate for the ear's relative insensitivity to extreme frequencies at low levels. As a result of this insensitivity, reproduced music played back at unrealistically low levels tends to sound "thin." Loudness contour controls boost the extreme bass and treble to provide a "fuller" sound. Two types of loudness contour controls predominate. The switched type adds boost according to the setting of the volume control. At high volume settings, switched loudness contour controls generally have no effect. At low volume setting, they have maximum effect. Continuously variable loudness contour controls operate independently of the volume control to reduce volume and add frequency compensation.

3.121 Follow steps 3.111 through 3.114.

3.122 Set the loudness contour control to the desired position. Remember that if it is a switch, the effect will vary according to the position of the volume control. If you turn the volume far down, you may need to move the Meter Range switch (8) to "0.1%."



3.123 Set the Oscillator control (11) to 20 Hz. Make a record of the top (2) and bottom (4) indicator readings. Repeat for each frequency up to 20 kHz. You can plot the output levels against frequency to make a curve of the contour effect. By repeating the procedure at various settings of the volume or contour controls, you can compile a family of related curves.



3.13 Equalizers, Filters, Crossovers

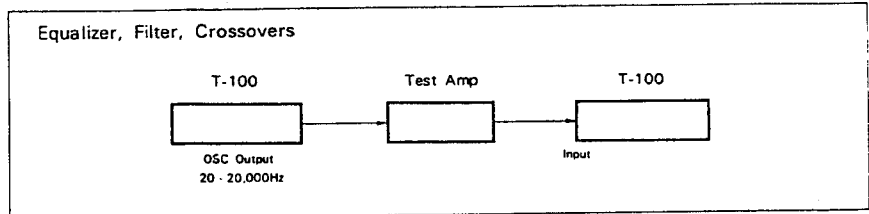
You can use the T-100 to measure the frequency effects of equalizers and filters, whether they are built into your preamplifier or separate components in your audio system. If they are built in, follow the procedure for tone controls, 3.11. If they are separate components, you can test them with the procedure below. You can also test each frequency-band output of a crossover network with this procedure.

3.131 Connect the Output jacks (16) to the Input jacks (15). Set the Function control (7) to "Level." Set the Oscillator control to 1 kHz. Set the Meter Range switch (8) to "1%," and the Input Level Switch (9) to "1V."

3.132 Turn the Oscillator Output control (12) so that the indicators read -6 dB. The oscillator will be calibrated at 500 mV output. This should be sufficient for most line-level devices. Check the owner's manual of the filter, equalizer, or crossover if you are in doubt.

3.133 Connect the Output jacks (16) to the line input jacks of the device. Connect the line output jacks of the device to the Input jacks (15).

3.134 Set the controls of the filter, equalizer, or crossover as desired.



3.135 Set the Oscillator control (11) to 20 Hz. Make a record of the top (2) and bottom (4) indicator readings. Repeat for each frequency up to 20 kHz. You can plot the output levels against frequency to make a curve of the device's frequency effects. By repeating the procedure at various settings, you can compile a family of curves. You may wish to measure a crossover's effects at each frequency-band output.

3.2 Overload

3.2 Phono Preamplifier Overload

Phono overload varies according to frequency, because of the nature of RIAA playback equalization. You will be measuring overload at 400 Hz.

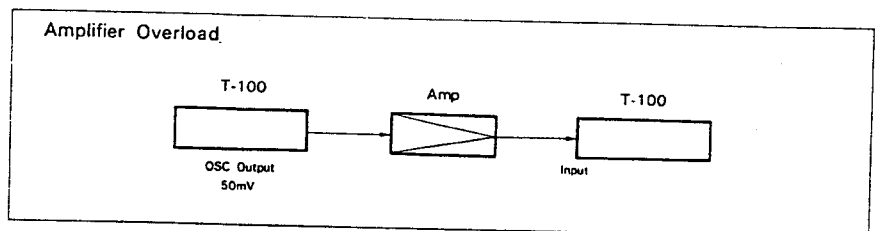
3.201 Connect the Output jacks (16) to the Input jacks (15). Set the Function control (7) to "level." Set the Oscillator control (11) to 400 Hz. Set the Meter Range switch (8) to "1%," and the Input Level switch (9) to "0.1V."

3.202 Turn the Oscillator Output control (12) so that the indicators read -6 dB. The oscillator output will be calibrated at 50 mV. This should be below the overload level of a modern, high-quality phono preamplifier. Check your preamplifier owner's manual if you are in doubt. Lowering the Oscillator Output control (12) so that the indicators read -12 dB will yield a 25 mV output.

3.203 If you are testing a separate preamplifier, disconnect the power amplifier to access the preamplifier output jacks. If you are testing an integrated amplifier or receiver, disconnect the "pre out/main in" plugs.

3.204 Connect the Output jacks (16) to the phono input jacks of your preamplifier. Connect the preamplifier output jacks to the Input jacks (15).

3.205 Set the preamplifier volume control to one-fourth full volume.



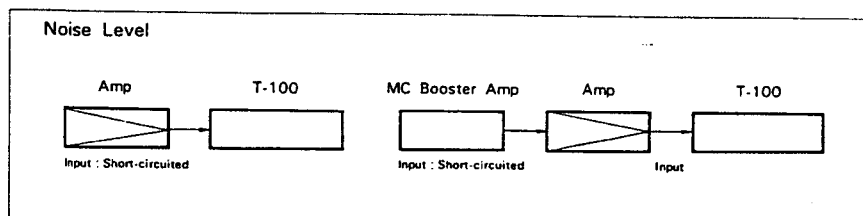
3.206 Set the Function control (7) to "Level T.H. Dist. R." Adjust the input level control so that the top indicator (2) indicates the preamplifier output level. Adjust the Meter Range switch (8) so that the bottom indicator (4) indicates the distortion level. (In some instances, distortion will be below the 0.01% range of the metering system.) Remember that for an accurate indication of distortion, the top indicator reading should be between -10 and +10 dB.

3.207 Advance the Oscillator Output control (12) until distortion increases rapidly, this is the point of preamplifier overload.

3.208 Do not change the oscillator output level. Disconnect the preamplifier and reconnect the Inputs (15) to the Outputs (16). Set the Function control (7) to "Level," and set the Meter Range (8) and Input Level (9) switches to get a reading of the oscillator output level on the indicators. Read the level in dB and use the Indicator Status Charts on page 3 to convert the reading into voltage. This, expressed in millivolts, will be the phono preamplifier right channel overload voltage.

3.219 Repeat the procedure for the left channel, using the Function control in the "Level T.H. Dist. L" position. If your preamplifier has switchable sensitivity, or two inputs of different sensitivity, repeat the procedure for each.

3.3 Noise Level



3.31 Phono Input

3.311 Short-circuit the phono inputs of your preamplifier with shorting plugs.

3.312 Connect the preamplifier outputs to the Input jacks (15).

3.313 Set the preamplifier volume control to maximum.

3.315 Set the Function control (7) to "Noise-A (-40dB)."

3.316 Set the Meter Range (8) and Input Level (9) switches to appropriate positions and read the A-weighted noise level.

3.322 Connect shorting plugs to the inputs of the booster.

3.323 Follow steps 3.312 through 3.316.

3.33 Aux, Tape Input

In most preamplifiers, you can expect the performance at the "aux" and "tape" inputs to be similar, if not identical.

3.331 Short the desired input, aux or tape.

3.332 Follow steps 3.312 through 3.316.

3.32 Phono Input with Moving Coil Booster

You can also measure phono input noise with a moving coil booster amplifier or transformer connected. You can expect the noise to be slightly higher with the booster. If the booster has gain controls, these may affect the noise level. Experiment with different gain control settings.

3.321 Connect the moving coil booster to the phono inputs of the preamplifier.

3.4 Volume Indication

3.41 Power Amplifier Peak Metering

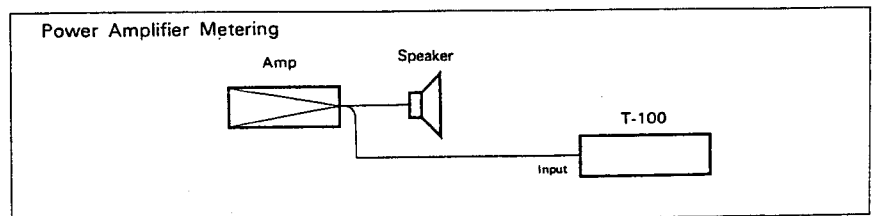
You can meter the power output of your power amplifier with the T-100. The peak metering, with its 10 millisecond rise time, is extremely fast and accurate, with no ballistic overshoot.

3.411 Connect the Input jacks (15) to the power amplifier speaker terminals so that the Analyzer is in parallel with your speakers.

3.412 Set the Function control (7) to "Peak."

3.413 You can read the relative output in dB. If you wish, you can adjust the left and right Input Level controls (10) to calibrate a 0 dB setting at a particular power output level (e.g., 20 dB below full output).

3.414 If you intend to use the T-100 for long-term power monitoring, you may wish to utilize the Wattage Scale (18) which is included as an accessory. This will enable you to read power in watts directly from the T-100 display. Fit the Wattage Scale (18) over the display portion of the T-100. Align the Wattage Scale so that its "10" volt indicator mark (voltage scale) fits right over the "0" dB indicator mark on the T-100's level scale (3). Set the Meter Range switch (8) to "1%". Set the input level switch (9) to "10 V". The Input Level controls (10) must be at maximum in order for the wattage readings to be accurate.



Note:

- (a) The Wattage Scale (18) provides direct readout of power in watts for an 8-ohm loudspeaker (or load). For a 4-ohm load, you must double the readings. For a 16-ohm load, you must halve the readings.
- (b) For more accurate readings of very low power levels, you can set the Input Level switch (9) to "1 V". All wattage readings must be divided by 100 in this case. For example, at this setting a 10 watt indication would actually mean 0.1 watt.

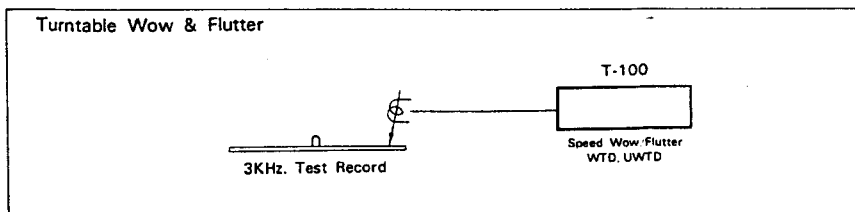
CAUTION

Under certain circumstances in the peak metering mode, it is possible to overload the input section circuitry of the T-100. Overload results in inaccurate readings and is indicated by arrested movement of the bar-graph display (the indicators will never "move" beyond a certain point). In such instances turning down the Input Level controls (10) will not help (electrically, they are positioned after the input circuitry). What does help is increasing the Input Level switch (9) setting (moving it up one step). A complementary decrease of the Meter Range switch (8) (moving it down, if it is not down already) will restore input sensitivity of the T-100 to the original level.

3.42 Power Amplifier VU Metering

You can also use the T-100's VU ballistics to meter power output. The indicator "movements" will be slower and easier to read, but you will be giving up the accurate indication of momentary peaks. The readings are useful, nevertheless, if you wish an indication of the average power levels encountered in day-to-day listening. The procedure for "VU" power amplifier metering is the same as for peak power metering (see preceding section), but instead of setting the function switch to "peak" (step 3.412), set it to "level". Remember that the left and right Input Level controls (10) have no effect in this mode.

4. Turntable



4.005 Play the 3 kHz test tone.

You can measure turntable wow & flutter with a 3 kHz test record.

4.001 Set the Function control (7) to "Speed Cal."

4.002 Adjust the Speed Cal control (6) so that the top indicator (2) reads zero on the speed deviation scale (1).

4.003 Set the Function control (7) to "Speed Wow/Flutter."

4.004 Connect the preamplifier output to the Input jacks (15).

4.006 The top indicator (2) shows speed deviation. The bottom indicator (4) shows weighted wow & flutter. Remember that the wow & flutter reading varies according to the position of the Meter Range switch (8). You can expect the wow & flutter reading to fluctuate. Read the center value.

4.007 For unweighted wow & flutter readings, set the Function control (7) to "Speed Unweighted."

5. Pink Noise

Pink noise is a useful tool in the subjective analysis of audio components. It is basically a form of random noise, but with a specifically defined spectral distribution. In simple terms, pink noise is a wideband "rushing" noise with components evenly spread across the entire audio frequency spectrum. This makes it a particularly ruthless means of aurally differentiating wide-bandwidth components from those with limited frequency response. Pink noise also enables the critical listener to detect small deviations from "flat" frequency response in a given component.

For example, pink noise can be used to aurally check the performance of a tape deck. This is an especially demanding test, witnessed by the fact that very few tape decks can accurately reproduce pink noise. With a three-head deck, begin by recording pink noise at -30 dB (-30 VU) and compare the original to the playback by flipping the "monitor" switch from "tape" to "source" and back. If you cannot tell the difference, move the recording levels up to -20 dB, or higher still. Eventually the deck will run out of high frequency headroom, and the character of the noise heard from "tape" will be quite different from the "source". The same tests can be made on a two-head deck by first recording 20 – 30 seconds of pink noise, rewinding and playing back, comparing the reproduced noise to the original (the signal from the T-100) by using the "tape monitor" switch on your preamplifier, integrated amplifier or receiver. You must

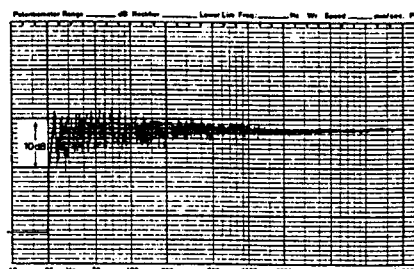
carefully adjust the output of the deck so that the listening levels are exactly the same for the two noise signals you are comparing. In this manner, you can use subjective pink noise testing to supplement procedure 1.14 (Record/Playback Frequency Response), procedure 1.23 (Record/Playback Level versus Distortion), and procedure 1.3 (Record/Playback Saturation).

Pink noise is also useful in differentiating the sonic qualities of different loudspeakers. Pink noise can be useful in judging the differences among various listening positions in the same room, or among different speaker positions from the same listening location. Pink noise reproduced over a loudspeaker can also help point out the sonic differences among microphones.

Although pink noise testing is not definitive in any way (unless you have access to a narrow-band spectrum analyzer), it can be instrumental in detecting and analyzing component coloration. A tape deck or amplifier that cannot accurately reproduce pink noise, for example, can be suspected of coloring (minutely perhaps) musical signals. In this way it is a good supplement to the wide range of objective measurements possible with the T-100.

Pink Noise Generator
Characteristics

1/3 Octave Analysis



Service Information, Specifications

Service Information

Although it is unlikely that your Nakamichi T-100 will require repair, should servicing ever become necessary, please consult your Nakamichi dealer or the Nakamichi dealer closest to you. As there are no user serviceable parts inside the unit, please do not attempt your own repairs.

Please read all accompanying Warranty Cards and/or notices very carefully.

Thank you for your confidence in Nakamichi products.

GENERAL

Input Impedance	50 kilohms
Scope Out	Low Impedance

OSCILLATOR (CR-type spot oscillator)

Spot Frequencies	20, 40, 63, 100, 160, 250, 400, 630, 1k, 1.5k, 2k, 3k, 4k, 5k, 6.3k, 8k, 10k, 12k, 15k, 18k, 20kHz plus pink noise (± 2 dB, 20–20,000Hz)
Output Voltage	1.2V max. (variable)
Level Deviation	± 0.2 dB (20–20,000Hz)
Output Distortion	Less than 0.3% (20–20,000Hz) Less than 0.01% 400Hz (for THD measurement)
Frequency Accuracy	$\pm 2\%$
Output Impedance	600 ohms

LEVEL MEASUREMENT

Range	–80 dB – +30 dB (re: 0 dB = 1V)
Frequency Response	20–20,000Hz ± 0.3 dB
Ballistics	Average (rms): 0.3 sec ("VU") Peak: 10 ms rise time 2 sec fall time (DIN peak)

WOW & FLUTTER MEASUREMENT

Center Frequency	3kHz
Input Level Range	3mV – 30V
Indication	DIN peak (wtd or uwtd, selectable)
Frequency Range	0.2 – 200Hz
Calibration (test signal)	3kHz ± 4.5 Hz ($\pm 0.15\%$)
Tape Speed Range	$\pm 3\%$

DISTORTION METER

Measurement frequency	400Hz
Input Voltage Range	100mV – 30V
Distortion Range	0.01% – 0.3%, 0.1% – 3%
Automatic Input Control Range ..	20 dB (–10 dB – +10 dB)
Frequency Characteristics	800Hz – 10kHz (± 0.3 dB)
Residual Noise	90 dB (input range: 0 dB) 85 dB (input range: –20 dB)
Fundamental Frequency	
Rejection	400Hz $\pm 0.3\%$, –100 dB (0.001%) 400Hz $\pm 0.5\%$, –70 dB (0.03%)

NOISE LEVEL MEASUREMENT

Frequency Characteristics	IHF-A Curve
Range	–100 dB – –10 dB (0 dB = 1 V)
Indication	Average Value
Power Requirements	100, 120, 220 or 240 Volts AC, 50/60Hz
Power Consumption	15 VA
Dimensions	343(W)x75(H)x240(D) millimeters 13½(W)x3(H)x9½(D) inches
Weight	4.3 kilograms, 9.5 pounds

- Specifications and appearance design are subject to change for further improvement without notice.

LEISTUNGSVERSTÄRKER

Watt-Messung

1. Eingang und Ausgang des T-100 verbinden.
2. Oszillator-Wahlschalter: 1 KHz
3. Funktionswahlschalter: "Level".
4. Meter-Range-Schalter: 1 %
5. Input-Level-Schalter: 1 V (OdB).
6. Oszillator-Spannung regeln, bis die Leuchtbalken OdB anzeigen ≈ 1 V Ausgangsspannung.
7. Ausgang des T-100 mit Eingang der Endstufe verbinden.
8. Ausgang der Endstufe normgerecht belasten (Abschlußwiderstände verwenden).
9. Eingang des T-100 durch Klippkabel mit den Lautsprecherausgängen parallel zu den Abschlußwiderständen verbinden.
10. Input-Level-Schalter des T-100 auf 10 V
11. Wattskala einsetzen.
12. Auf der Wattskala können Sie nun direkt die Ausgangsleistung an 8 Ohm ablesen (bei 4 Ohm Abschluß angezeigten Wert mit 2 multiplizieren).

Klirrfaktormessung

- 1.-9. siehe Wattmessung
10. Wattskala entfernen.
11. Oszillator-Wahlschalter: 400 Hz
12. Meter-Range-Schalter: 0,1 %
13. Funktionswahlschalter: "Level" THD (400 Hz).
14. Zwischen L und R umschalten und auf der unteren %-Skala den Klirrfaktor für den jeweiligen Kanal ablesen (da Meter-Range-Schalter auf 0,1 % steht, ist das Komma der angezeigten Werte um eine Stelle nach links zu verschieben: 0,1 = 0,01 %).



INTERSONIC

Elektrohandelsges. mbH. & Co.
Wandalenweg 14-20
2000 Hamburg 1
Tel.: 040/28 74-1



T-100 MESS-METHODE FÜR AUDIO SERVICE

Phono-RIAA-Entzerrung

1. Funktionswahlschalter: Level -20dB
2. Oszillator-Wahlschalter: 1 kHz
3. Meter-Range-Schalter: 1%
4. Input-Level-Schalter: 0,1 V
5. Eingang und Ausgang des T-100 miteinander verbinden.
6. Oszillator-Output-Regler verändern, bis die Leuchtbalkenanzeige bei -6dB liegt.
7. Ausgang des T-100 mit Phonoeingang verbinden.
8. Ausgang der Vorstufe mit dem Eingang des T-100 verbinden.
9. Phono-Empfindlichkeitswahlschalter, wenn vorhanden, auf 5 mV einstellen.
10. Funktion Phono anwählen.
11. Die Ausgangsspannung mit dem Poti des Vorverstärkers verändern, bis die Anzeige beim T-100 0dB beträgt.
12. Oszillatorfrequenz 250 Hz wählen: die Anzeige muß nun +6,68dB gegenüber 0dB bei 1 kHz betragen.
13. Oszillatorfrequenz 10 kHz wählen: die Anzeige muß nun -13,73dB gegenüber 0dB bei 1 kHz betragen.

Diese Messung kann prinzipiell über den gesamten Frequenzbereich durchgeführt werden. Die RIAA-Kennwerte finden Sie in der Tabelle der englischen Bedienungsanleitung auf Seite 18.

Geräuschspannungsabstand der Eingänge (bezogen auf 0dB $\pm$ 1V)

1. Input des T-100 mit Output des Vorverstärkers verbinden.
2. Funktion Phono anwählen.
3. Funktionswahlschalter: Noise A (-40dB)
4. Input Level des T-100: 0,1 (-20dB)
5. Alle Eingänge anwählen und Geräuschspannungsabstand am T-100 ablesen.
6. Der jeweils zu messende Eingang ist vorher gegen Masse kurzzuschließen (Kurzschlußstecker).

Bei oben genannter Schalterstellung entspricht die Anzeige 0dB nun einem Rauschabstand von -60dB.

Sollte in dieser Empfindlichkeitsstellung keine Anzeige sichtbar sein, kann der Empfindlichkeitswert der Skala auf 0,1% angehoben werden (Meter Range des T-100: 0,1%).

Die Anzeige 0dB entspricht jetzt einem Geräuschspannungsabstand von -80dB. Der Geräuschspannungsabstand soll den im Datenblatt (Service Manual) angegebenen Werten entsprechen.

TAPE-MESSUNGEN

Azimuth

1. Vor der Messung sind die Köpfe zu entmagnetisieren.
2. Ausgang Tape mit Eingang T-100 verbinden.
3. Funktionswahlschalter: -20dB
4. Meter-Range-Schalter: 1 %
5. Input-Level-Schalter: 1 V
6. Azimuth-Band einlegen.
7. Output auf max.-Stellung.
8. Wiedergabe starten und Azimuth-Schraube des Wiedergabe-Kopfes (siehe Service-Manual des Herstellers) verändern, bis max. Ausgangs-Pegel auf beiden Kanälen erreicht ist.

Frequenzgang (Grenzfrequenzen)

1. Azimuth-Justierung des zu messenden Gerätes kontrollieren.
2. Funktionswahlschalter: Level
3. Meter-Range-Schalter: 1 %
4. Input-Level: 1 V
5. Wahlschalter für Oszillatorfrequenz: 400 Hz.
6. Output des T-100 mit Hochpegeleingang des zu messenden Decks verbinden.
7. Eingang des T-100 mit Ausgang des zu messenden Decks verbinden.
8. Deck auf Aufnahme/Pause schalten und mit den Aussteuerungsreglern des Decks und dem Regler für die Ausgangsspannung des Oszillators (12) "0dB" an den VU-Metern des Decks einstellen.

9. Ca. 10 Sekunden das Signal (400 Hz, 0dB) aufnehmen. Aufnahme erfolgt automatisch für linken und rechten Kanal.
10. Band zurückspulen und wiedergeben. Hierbei den Volumenausgangsregler des Decks so einstellen, daß auf der Skala des T-100 "0dB" als Anzeige zu lesen ist. (Eventuell am T-100 mit Schalter 8 oder 9 die Eingangsempfindlichkeit anpassen).
11. Deck erneut auf Aufnahme schalten und mit Aussteuerungsregler des Decks den Pegel um 6dB absenken. Anschließend Funktionswahlschalter des T-100 (7) in Stellung „Level -20dB“ bringen.
12. Untere Grenzfrequenz (lt. Herstellerangabe) mit dem Oszillator-Frequenzwahlschalter einstellen und dieses Signal ca. 10 Sekunden aufnehmen.
13. Obere Grenzfrequenz (lt. Herstellerangabe) mit dem Oszillator-Frequenzwahlschalter einstellen und ebenfalls ca. 10 Sekunden aufnehmen.
14. Band zurückspulen und Wiedergabepegel am T-100 ablesen. Die Abweichung (von 0dB zu 400 Hz) zeigt die Anhebung bzw. Absenkung der jeweiligen Grenzfrequenz an.

Achtung: Bei Aufnahme der oberen Grenzfrequenz MPX-Schalter nicht aktivieren. Bei 3-Kopf-Maschinen kann über die Hinterbandfunktion der Wert sofort bei der Aufnahme abgelesen werden.

Klirrfaktor

- 1.-10. siehe Messungen Frequenzgang
11. Oszillator-Wahlschalter: 400 Hz
12. Aufnahme für 400 Hz starten und Anzeige des T-100 mit Aussteuerungsregler des Decks auf OdB regeln.
13. Funktionswahlschalter auf Level THD-R und ca. 30 Sekunden aufnehmen. Aufnahme erfolgt automatisch für linken und rechten Kanal.
14. Zurückspulen, Wiedergabe und auf der unteren Skala Klirrfaktor in % für den rechten Kanal ablesen.
Nach ca. 15 Sekunden Funktionswahlschalter auf Level THD-L umschalten und Klirrfaktor ebenfalls auf der unteren Skala in % ablesen.
15. Die jeweilige Ausgangsspannung wird auf der oberen Skala abgelesen.

Wow/Flutter

1. Ausgang Tape mit Eingang T-100 verbinden.
2. Meter-Range-Schalter: 0,1 %
3. Input-Level-Schalter: 1 V
4. Funktionswahlschalter: Speed Cal.
5. Regler Speed Cal. solange verändern, bis auf der oberen Speed-Skala der Wert "O" erreicht ist.
6. Funktionswahlschalter nun auf Speed/Wow & Flutter, bewertet.
7. Wow & Flutter-Cassette (3 KHz) einlegen und Tape auf Wiedergabe schalten.
8. Auf der oberen Skala lesen Sie die Abweichungen von der Soll-Geschwindigkeit ab.
9. Auf der unteren Skala werden die Werte für Wow & Flutter angezeigt.